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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/902,483 | 07/11/2001 | Cyril Cabral JR. | YO999-408 CIP | 7319 |

21254 7590 02/13/2004
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EXAMINER

KIELIN, ERIK J

ART UNIT PAPER NUMBER

2813

DATE MAILED: 02/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

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|------------------------------|--------------------------------------|--------------------------------------|--|
| Office Action Summary | Application No. 09/902,483 | Applicant(s) CABRAL ET AL. | |
| | Examiner Erik Kielin | Art Unit 2813 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) _____ is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) _____ is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>9/23/03</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 24 November 2003 has been entered.

Claim Objections

2. Claims 8 and 26 are objected to because of the following informalities:

in claim 8, line 7, replace "said depositing" with --said depositing of said silicon cap-- for clarity; and

in claim 26, line 7, replace "second phase" with --second silicide phase-- for clarity.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is unclear, as presently written, as to what “a mixture” refers. It appears the specification indicates that the mixture refers back to the limitation in independent claim 10 of the metal co-deposited with silicon.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-3, 23, and 4-6, 8, 12, 24, and **10**, 11, 31, 32, and **13, 25, 26**, 27-30, and 33-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,830,775 (**Maa et al.**) in view of US 5,828,131 (**Cabral, Jr. et al.**).

Regarding independent claims 1, 4, 13, 25, and 26, **Maa** discloses a method for fabricating a silicide for a semiconductor device, comprising

providing a substrate having a silicon layer (Fig. 1) or a bulk silicon substrate (Fig. 3) (col. 4, lines 13-54);

depositing a metal alloy layer **80** (Fig. 4; col. 2, lines 60-67; col. 4, line 62 to col. 5, line 4);

reacting the metal alloy layer **80** to form a first metal-rich silicide phase layer **90**, using RTA (rapid thermal annealing) (Fig. 5; col. 5, lines 5-65);

selectively etching any unreacted metal alloy while leaving behind the metal-rich silicide **90** (Fig. 6; col. 6, lines 29-49);

depositing a silicon cap layer **110** without using epitaxial processes (Fig. 7; col. 6, line 50 to col. 7, line 15);

reacting the cap layer **110** to form a second silicide phase layer (CoSi_2) **122**, **124**, **126** using RTA (Figs. 8 and 9; col. 7, lines 16-45); and

etching any unreacted silicon cap layer (Fig. 9; col. 7, lines 46-64).

(See also Fig. 10.)

Regarding claims 2 and 3, as noted above, the substrate may be either bulk or SOI.

Regarding claims 5 and 6, the metal alloy may include Co, Ti, or Ni which is 50 Å to 300 Å thick (5 to 30 nm), which anticipates 7 nm to 8 nm (col. 4, line 62 to col. 5, line 4).

Regarding claim 8, as noted above, the reacting of said metal alloy comprises RTA to form a metal-silicon phase by reaction with the underlying bulk silicon substrate; wherein the etching is selective to remove unreacted metal; wherein the silicon cap layer is blanket deposited; and wherein reacting the silicon cap layer is performed by RTA to form a metal di-silicide.

Regarding claim 12, the source/drain regions are shown to be elevated.

Regarding claims 23 and 24, the first silicide phase is the first forming silicide phase.

Regarding claims 27, 29, 31, 33, 35, and 37, the first silicide phase is metal-rich.

Regarding claims 28, 30, 32, 34, 36, and 38, it is seen to be inherent that the metal alloy extends the temperature window in which a silicide metal-rich phase exists, because Applicant indicates that a window is directly related to quantity of metal present in metal alloy. (See Applicant's specification p. 16, lines 3-8.) In other words, the more metal that is present relative to silicon the longer the window. Consequently if an alloy absent silicon is used, the window is a larger than if silicon is present. See *In re Swinhart*, 169 USPQ 226,229 (CCPA 1971) (where the

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Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that subject matter shown to be in the prior art does not possess the characteristics relied on) and *In re Fitzgerald*, 205 USPQ 594 (CCPA 1980) (the burden of proof can be shifted to the applicant to show that subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 USC 102 or obviousness under 35 USC 103).

As applied to all each of the claims above, the prior art of **Maa**, fails to indicate if the metal or metal alloy contain silicon are deposited to form the silicide.

Cabral teaches the benefits of using metal alloys which contain silicon to form silicides on silicon layers. (See Abstract; col. 6, lines 4-16.)

It would have been obvious for one of ordinary skill in the art, at the time of the invention to modify **Maa** to use an alloy containing silicon as taught by **Cabral** because **Cabral** teaches that the metal alloy containing silicon provides greater thermal stability to the silicide than the pure metal alone and because **Maa** suggests using other alloys, specifically stating that one of ordinary skill would know what alloys to use. (See Maa paragraph bridging cols. 4-5.)

Double Patenting

7. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

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A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

8. Claims 1, 4, 10, 25, and 26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 24, 28-31 of U.S. Patent No. US 6,503,833 B1 (**Ajamera et al.**). Although the conflicting claims are not identical, they are not patentably distinct from each other because each teaches the same method of forming the silicide regions by dependent a metal containing silicon followed be equivalent process steps. Note that a “metal-silicon mixture” is equivalent to a “metal containing silicon.” The patent cannot be infringed without also infringing the application and vice versa.

9. Claims 1, 4, 10, 25, and 26 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 24 and 28-31 of copending Application No. 10/287,476. Although the conflicting claims are not identical, they are not patentably distinct from each other because each teaches the same method of forming the silicide regions by dependent a metal containing silicon followed be equivalent process steps. Note that a “metal-silicon mixture” is equivalent to a “metal containing silicon.” The patent cannot be infringed without also infringing the application and vice versa.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

10. Claims 1, 4, 10, 25, and 26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 and 27 of U.S. Patent No.

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6,444,578 B1 (**Cabral**, Jr., et al.). Although the conflicting claims are not identical, they are not patentably distinct from each other because each teach the same method of forming the silicide regions by dependent a metal containing silicon followed be equivalent process steps.

11. Claims 1, 4, 10, 25, and 26 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 4, 5, and 23 of copending Application No. 10/299,688. Although the conflicting claims are not identical, they are not patentably distinct from each other because each teaches the same method of forming the silicide regions by dependent a metal containing silicon followed be equivalent process steps. Note that a “metal-silicon mixture” is equivalent to a “metal containing silicon.” The patent cannot be infringed without also infringing the application and vice versa.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

12. Claims 1, 4, 10, 25, and 26 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 15 and 20 of copending Application No. 09/569,306. Although the conflicting claims are not identical, they are not patentably distinct from each other because each teaches the same method of forming the silicide regions by dependent a metal containing silicon followed be equivalent process steps. Note that a “metal-silicon mixture” is equivalent to a “metal containing silicon.” The patent cannot be infringed without also infringing the application and vice versa.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Response to Arguments

13. Applicant's arguments filed 24 November 2003 have been fully considered but they are not persuasive.

Applicant argues that Maa does not teach a metal alloy. Applicant is grossly mistaken, as pointed out numerous times. **Maa expressly states that a METAL ALLOY is deposited on the substrate at the location col. 5 first sentence**, so Applicant's *ad nauseum* insistence that Maa does not teach depositing a metal alloy blatantly and intentionally ignores the facts of record and the numerous times that this fact has been pointed out to Applicant. Accordingly, Applicant is narrowing the claims in order to overcome the prior art. Originally Applicant claimed a metal and a metal alloy. The "metal containing silicon" was not added until the provision of prior art anticipating the claims. Applicant's numerous amendments to the claims makes claim that the claims have been narrowed with respect to the material being deposited to form the silicide layer. Accordingly, the instant application is **not** entitled to the doctrine of equivalents with respect to the material being deposited from which the silicide is made, in accordance with precedent.

Further in this regard, Applicant argues that he is entitled to file a divisional application because Maa fails to teach a metal alloy. While Applicant may file as many applications as Applicant chooses to spend money prosecuting, "in the context of the [instant] invention" the Maa reference is a 102(b) piece of prior art relative the use of metals and metal alloys to form silicides in the manner both claimed and disclosed in the present application. Certainly, claims drawn to the use of metals and metal alloys in the manner disclosed in the instant specification **would never be enforceable over the Maa reference**, as the instant record makes clear.

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Applicant argues that the double patenting rejections are improper. Applicant is wrong for the reasons indicated in the rejections above. The double patenting rejection is proper.

The remainder of Applicant's arguments are moot in view of the new grounds of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. On or about 5 February 2004, this number will change to 571-272-1693. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940 (new telephone number will be 571-272-1702). The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Erik Kielin
Primary Examiner
February 7, 2004